REMARKS

In the Office Action of May 9, 2002, Claims 1 - 8 and 12 - 23 were rejected. No claim was allowed. In response, Claims 1 - 4 and 13 - 22 are amended. Reexamination and reconsideration are respectfully requested in view of the foregoing amendments and the following remarks.

Objection to the Drawings

The drawings were objected to under 37 CFR 1.83(a). The alleged grounds for objection include inconsistent reference characters and incorrect spelling.

In response, Applicants submit corrected drawings by a separate Letter to the Official Draftsman.

Accordingly, it is respectfully submitted that the objections to the drawings are thereby overcome.

Objections to the Claims

Claim 3, 17 and 20 were objected to on account of various informalities.

In response, Claims 3 and 20 are corrected as suggested by the Examiner and Claim 17 is amended to depend from Claim 16 instead of Claim 18.

Accordingly, it is respectfully submitted that the objections to the claims are overcome.

Rejection of Claim 4 under 35 U.S.C. §112, first paragraph

Claim 4 was rejected under 35 U.S.C. §112, first paragraph, as based on a disclosure that is not enabling. The Examiner notes that the claim recites "fluorine nitric acid", which the Examiner alleges is an unknown compound.

In response, Claim 4 is amended to delete "fluorine nitric acid" and recite --hydrofluoric acid or nitric acid--.

Accordingly, it is respectfully submitted that the rejection under 35 U.S.C. §112, first paragraph, is thereby overcome.

Rejection of Claims 2, 13 - 16, 18 and 20 - 22 under 35 U.S.C. §112, second paragraph

Claims 2, 13 - 16, 18, and 20 - 22 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite.

In particular, regarding Claims 2 and 20 - 22, the Examiner alleges that the term "continuously" applied to the process steps would not allow other process steps to take place. In response, Claims 2 and 20 - 22 are amended to delete the term "continuously" and to clarify that the process steps are carried out --in continuous succession--.

Regarding Claims 13 - 16 and 18, the Examiner questions how close contact differs from being in contact. In response, Claims 13 - 16 and 18 are amended to delete the term "close".

Regarding Claim 14, the Examiner questions the meaning of the recitation that layers are "connected". In response, Claim 14 is amended to change the term "connected" to the term --contacted--.

Regarding Claim 13 and 20, the Examiner alleges that phrases "such as" and "or the like" render these claims indefinite. In response, Claims 13 and 20 are amended to delete these phrases.

Regarding Claim 21, the Examiner alleges that the limitation "carrying out the plasma etching steps 1 - 5" lacks antecedent basis in Claim 19. In response, the dependency of Claim 21 is changed to Claim 20, which provides antecedent basis for the recited steps.

Accordingly, it is respectfully submitted that all of the rejections of Claims 2, 13 - 16, 18 and 20 - 22 under 35 U.S.C. §112, second paragraph, are overcome.

Rejection of Claims 19 and 21 under 35 U.S.C. §102(e) over O'Donnell

Claims 19 and 21 were rejected under 35 U.S.C. §102(e) as anticipated by O'Donnell et al (U.S. Patent No. 6,069,035). The Examiner alleges that O'Donnell teaches a method of etching a metal layer, such as the NiFe alloy used in the fabrication of read/write magnetic heads, teaches plasma etching of a metal layer that is deposed beneath an etching mask and teaches rinsing the substrate to remove residual material.

This rejection is traversed as it may apply to Claims 19 and 21 as amended herein. In particular, Claims 19 and 20 are amended to provide that drying is carried out by placing the rinsed body on a hot plate. The drying step is disclosed in the substitute specification of the present invention on, for example, page 19, line 24 - 25. Claims 19 and 21 are thus distinguished from O'Donnell, which does not contain a drying step.

As an explanation of the drying step, when a transition metal such as NiFe is etched by a Cl_2 series gas, corrosion thereof is comparatively severe, and corrosion after etching cannot be prevented by simple rinsing. In the present invention, it was discovered that if the rinsed body is immediately (within 10 seconds) placed on a hot plate at about 200°C to drive away the residual water, complete corrosion prevention can be achieved. This feature is neither disclosed nor suggested by O'Donnell.

Accordingly, it is respectfully submitted that the rejection of Claims 19 and 21 under 35 U.S.C. §102(e) over O'Donnell is thereby overcome.

Rejection of Claims 1 - 7 under 35 U.S.C. §103(a) over O'Donnell

Claims 1 - 7 were rejected under 35 U.S.C. §103(a) as anticipated by O'Donnell. The Examiner alleges that O'Donnell teaches the steps of the invention, except drying the substrate after it has been rinsed with water. The Examiner alleges that it would have been obvious to dry the substrate, and that drying would be an inherent aspect, since the substrate would eventually become dry.

This rejection is respectfully traversed as it may apply to Claims 1 - 7 as amended herein. The independent claims of the application are amended to provide that the specimen created by the method steps is dried by placing it on a hot plate after the rinsing step. This feature is neither disclosed nor suggested by O'Donnell. In particular, if the specimen is allowed to dry without heating, the drying may take considerable minutes to achieve complete drying. During a natural drying, any residual chlorine components that are not removed by water rinsing would have much time to react with water on the not yet dried wafer surface, thereby advancing the corrosion of the surface. The present invention prevents this by the recited step of drying the specimen by placing it on a hot plate.

Accordingly, it is respectfully submitted that the rejection of Claims 1 - 7 under 35 U.S.C. §102(e) over O'Donnell is thereby overcome.

Rejection of Claim 8 under 35 U.S.C. §103(a) over O'Donnell in view of Takagi

Claim 8 was rejected under 35 U.S.C. §103(a) over O'Donnell in view of Takagi (U.S. Patent No. 5,520,716). The Office Action alleges that O'Donnell teaches steps of the invention except that the PERMALLOY™ layer is etched on a sintered Al_2O_3/TiC substrate and that Takagi teaches a sintered Al_2O_3/TiC substrate for magnetic heads.

This rejection is traversed. As discussed above, Claim 1, from which Claim 8 depends, is amended to provide that the specimen created by the method steps is dried

by placing it on a hot plate after the rinsing step. This feature is neither disclosed nor suggested by O'Donnell or Takagi.

Accordingly, it is respectfully submitted that Claim 8 would not have been obvious over O'Donnell or Takagi, alone or in combination.

Rejection of Claim 14 under 35 U.S.C. §103(a) over O'Donnell in view of Otsuka

Claim 14 was rejected under 35 U.S.C. §103(a) over O'Donnell in view of Otsuka (U.S. Patent No. 6,282,776). The Office Action alleges that Otsuka teaches the steps of the invention, except removing chlorine or fluorine residue with a liquid rinse, and that a liquid rinse is taught by O'Donnell.

This rejection is traversed. Claim 14 is amended to provide that the rinsed body is dried by placing it on a hot plate after the rinsing step. This feature is neither disclosed nor suggested by O'Donnell or Otsuka.

Accordingly, it is respectfully submitted that Claim 14 would not have been obvious over O'Donnell or Otsuka, alone or in combination.

Rejection of Claims 13, 15 - 18, 20, 22 and 23 under 35 U.S.C. §103(a) over Otsuka in view of O'Donnell and further in view of Ichihara

Claims 13, 15 - 18, 20, 22 and 23 were rejected under 35 U.S.C. §103(a) over Otsuka in view of O'Donnell and further in view of Takagi (U.S. Patent No. 5,607,599). The Office Action alleges that Otsuka and O'Donnell in combination teach the steps of the invention, except for plasma etching seed or shield layers with argon and chlorine and that Ichihara teaches etching NiFe alloy layers such as seed and shield layers with an argon and chlorine plasma.

This rejection is traversed. The independent claims of the application are amended to provide that the specimen created by the method steps is dried by placing

it on a hot plate after the rinsing step. This feature is neither disclosed nor suggested by Otsuka, O'Donnell or Ichihara..

Accordingly, it is respectfully submitted that Claims 13, 15 - 18, 20, 22 and 23 would not have been obvious over Otsuka, O'Donnell and Ichihara, alone or in combination.

Conclusion

In view of the foregoing amendments and remarks, it is respectfully submitted that Claims 1 - 8 and 12 - 23 are in condition for allowance. Favorable reconsideration is respectfully requested.

Should the Examiner believe that anything further is necessary to place this application in condition for allowance, the Examiner is requested to contact applicants' undersigned attorney at the telephone number listed below.

Kindly charge any additional fees due, or credit overpayment of fees, to Deposit Account No. 01-2135 (503.38156X00).

Respectfully submitted,

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Attachment: Marked-Up Copy To Show Changes Made

ATTACHMENT

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IN THE CLAIMS:

1. (Twice amended) A method of processing a specimen comprising:

a first step of etching a specimen, which is a lamination layer formed on a substrate and includes at least one layer made of NiFe alloy or NiFeCo alloy, by gas plasma with a gas which contains chlorine at a temperature of the specimen below 200°C in an etching chamber;

a second step of removing a residual chlorine component deposited on an exposed portion of said lamination layer during said first step, and eliminating debris deposited on a side wall thereof by rinsing the same using at least one liquid; and

a third step of drying the specimen after the rinsing thereof by placing the specimen on a hot plate and by heating the specimen.

2. (Amended) A method of processing a specimen according to claim 1, wherein said second step is executed ~~continuously~~ in continuous succession after said first step.

3. (Amended) A method of processing a specimen according to claim 1, wherein said gas plasma is generated using at least one of Cl_2, ~~BCl_2~~ BCl_3, Ar and O_2 gases, or a combination thereof.

4. (Amended) A method of processing a specimen according to claim 1, wherein said second step of liquid rinsing includes one or more than two of the following steps:

(A) pure water rinsing,

(B) alkaline liquid cleaning followed by water rinsing,

(C) acidic liquid cleaning followed by water rinsing,

(D) ~~fluorine~~ hydrofluoric acid or nitric acid cleaning followed by water rinsing,

(E) neutral detergent cleaning followed by water rinsing.

13. (Twice amended) A method of manufacture of a magnetic head having an upper magnetic pole and a lower magnetic pole disposed opposite thereto and including a seed layer processing thereof, comprising the steps of:

forming a lamination layer comprising a seed layer made of NiFe or NiFeCo alloy, an upper magnetic pole made of NiFe alloy ~~connected~~ contacted to said seed layer, a gap layer made of an oxide such as alumina~~,~~ or silicon oxide ~~or the like~~ in ~~close~~ contact with said seed layer, and a shield layer made of NiFe alloy in ~~close~~ contact with said gap layer;

plasma-etching said seed layer using a gas which contains chlorine with said upper magnetic pole used as its mask; ~~and~~

removing a residual chlorine component by liquid rinsing; and

drying the rinsed body formed by the above steps by heating after placing the same on a hot plate.

14. (Amended) A method of manufacture of a magnetic head having an upper magnetic pole and a lower magnetic pole disposed opposite thereto and including a gap layer processing thereof, comprising the steps of:

forming a lamination layer comprising a seed layer made of NiFe or NiFeCo alloy, an upper magnetic pole made of NiFe alloy ~~connected~~ contacted to said seed layer, a gap layer made of an oxide film in ~~close~~ contact with said seed layer, and a shield layer made of NiFe alloy in ~~close~~ contact with said gap layer;

etching said seed layer;

etching said gap layer by plasma processing using a gas which contains chlorine or fluorine with said upper magnetic pole used as its mask; ~~and~~

removing a residual chlorine and/or fluorine components by liquid rinsing; and

drying the rinsed body formed by the above steps by heating after placing the same on a hot plate.

15. (Amended) A method of manufacture of a magnetic head having an upper magnetic pole and a lower magnetic pole disposed opposite thereto and including a trim-processing thereof, comprising the steps of:

forming a lamination layer comprising a seed layer made of NiFe or NiFeCo alloy, an upper magnetic pole made of NiFe alloy ~~connected~~ contacted to said seed layer, a gap layer made of an oxide film in ~~close~~ contact with said seed layer, and a shield layer made of NiFe alloy in ~~close~~ contact with said gap layer;

etching said seed layer;

etching said gap layer;

trim-etching said shield layer using a gas which contains chlorine by plasma processing with said upper magnetic pole used as its mask; ~~and~~

removing a residual chlorine component by liquid rinsing; and

drying the rinsed body formed by the above steps by heating after placing the same on a hot plate.

16. (Amended) A method of manufacture of a magnetic head having an upper magnetic pole and a lower magnetic pole disposed opposite thereto, comprising the steps of:

forming a lamination layer comprising a seed layer made of NiFe or NiFeCo alloy, an upper magnetic pole made of NiFe alloy ~~connected~~ contacted to said seed

layer, a gap layer made of an oxide film in ~~close~~ contact with said seed layer, and a shield layer made of NiFe alloy in ~~close~~ contact with said gap layer;

plasma-etching said seed layer, said gap layer and said shield layer consecutively with said upper magnetic pole used as a mask; and

applying a corrosion prevention treatment for removal of a residual chlorine component deposited on an etched surface thereof, including rinsing of the body to be treated and drying the same by heating after placing the same on a hot plate.

17. (Amended) A method of manufacture of a magnetic head according to claim ~~18~~ 16, wherein said gap layer is etched by gas plasma containing fluorine, said seed layer and said shield layer are etched by gas plasma containing chlorine and argon, and wherein said the rinsing in said corrosion prevention treatment is carried out ~~by with a~~ liquid ~~rinsing~~.

18. (Amended) A method of manufacture of a magnetic head having an upper magnetic pole and a lower magnetic pole disposed opposite to each other, comprising the steps of:

forming a lamination layer comprising a seed layer made of NiFe or NiFeCo alloy, an upper magnetic pole made of NiFe alloy ~~connected~~ contacted to said seed layer, a gap layer made of an oxide film in ~~close~~ contact with said seed layer, and a shield layer made of NiFe alloy in ~~close~~ contact with said gap layer;

plasma-etching said seed layer and said gap layer consecutively with said upper magnetic pole used as a mask; and subsequently,

applying a corrosion prevention treatment for removal of a residual chlorine component deposited on an etched surface thereof, including rinsing of the body to be treated and drying the same by heating after placing the same on a hot plate.

19. (Amended) A method of manufacture of a magnetic head having an upper magnetic pole and a lower magnetic pole disposed opposite to each other for manufacturing said upper magnetic pole thereof, comprising the steps of:

forming a lamination layer comprising an upper magnetic pole layer made of NiFe alloy, and a mask layer of a photo resist or an oxide film made of alumina or silicon oxide film which is laminated on said upper magnetic pole;

plasma etching said upper magnetic pole using said mask layer as its mask; and then

applying a corrosion prevention treatment for removal of a residual chlorine component deposited on an etched surface thereof, including rinsing of the body to be treated and drying the same by heating after placing the same on a hot plate.

20. (Amended) A method of manufacture of a magnetic head having an upper magnetic pole and a lower magnetic pole disposed opposite to each other and including a process for manufacture of said upper magnetic pole thereof, comprising the steps of:

forming a lamination layer comprising, sequentially from above,

(A) a photo resist film,

(B) an oxide film layer made of alumina, or silicon oxide ~~or the like~~,

(C) an upper magnetic pole layer made of NiFe alloy,

(D) a seed layer made of NiFeCo alloy for bonding said NiFe alloy,

(E) a gap layer made of an oxide film ~~such as~~ of alumina, or silicon oxide ~~or the like~~, and

(F) a shield layer made of NiFe alloy;

carrying out the following plasma etching steps ~~continuously~~ in continuous succession,

(Step 1) etching said oxide film layer using said mask layer as its mask,

(Step 2) etching said upper magnetic pole layer using said 5 oxide film layer as it mask,

(Step 3) etching said seed layer using said upper oxide film layer or said upper magnetic pole layer as its mask,

(Step 4) etching said ~~gas~~ gap layer using said upper oxide film layer and said upper magnetic pole layer as its mask, and

(Step 5) trim-etching said shield layer using said upper oxide film layer and said upper magnetic pole layer; and after that,

applying a corrosion prevention treatment for removing a residual chlorine component deposited on an etched surface thereof, including rinsing of the body to be treated and drying the same by heating after placing the same on a hot plate.

21. (Amended) A method of manufacture of a magnetic head according to claim ~~19~~ 20, comprising carrying out any steps of said plasma etching steps 1-5 ~~continuously~~ in succession, then applying said corrosion prevention treatment for removal of the residual chlorine component deposited on the etched surface thereof.

22. (Amended) A method of manufacture of a magnetic head according to claim 20, comprising carrying out ~~a~~ the rinsing/drying process for each step of said plasma etching steps 1-5 for removing a residual chlorine component and a debris on a side wall, said rinsing/drying process being executed ~~continuously~~ in continuous succession within a single unit.